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# *Maintaining Market Quality of*
# FRESH LYCHEES
# During Storage and Transit

Marketing Research Report No. 770

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Agricultural Research Service
UNITED STATES DEPARTMENT OF AGRICULTURE

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## CONTENTS

| | Page |
|---|---|
| Summary | 1 |
| Introduction | 1 |
| Materials and methods | 2 |
| Storage and holding tests—1961 | 2 |
| Shipping tests—1962–64 | 3 |
| Storage and holding tests—1961 | 3 |
| Color | 3 |
| Decay | 3 |
| Flavor | 3 |
| Shipping tests—1962–64 | 5 |
| Temperatures and time in transit | 5 |
| Air freight | 5 |
| Refrigerated truck | 5 |
| Arrival condition | 6 |
| Color | 6 |
| Decay | 6 |
| Flavor | 6 |
| Weight loss | 6 |
| Atmospheres | 6 |
| Condition after storage (45° F.) | 6 |
| Color | 6 |
| Decay | 8 |
| Flavor | 8 |
| Condition after holding (70° F.) | 8 |
| Color | 8 |
| Decay | 9 |
| Flavor | 9 |
| Literature cited | 9 |

Washington, D. C. Issued November 1966

# MAINTAINING MARKET QUALITY OF FRESH LYCHEES DURING STORAGE AND TRANSIT

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## SUMMARY

The use of sealed polyethylene bags combined with refrigerated storage resulted in satisfactory commercial control of browning of lychees in storage; perforated bags were slightly less effective. Storage at 50° F. for 7 days in sealed polyethylene bags resulted in fruit with a brighter red color than storage at 35°. Browning was most rapid at 70°. Storage at 35° and 50° reduced decay effectively. Decay was most prevalent at 70° in polyethylene bags.

All test shipments of lychees from Florida to New York by air freight and refrigerated truck arrived in good condition; less than 2 percent of the fruit exhibited decay. Lychees packed in polyethylene bags retained a fresher appearance and a brighter color than those packed loosely in the conventional manner; also, there was less weight loss in the bagged fruit.

The color of lychees from bags and from conventional packages was commercially acceptable after 5 days at 45° or 70° F. Fruit packed and shipped in bags continued to have less browning during postshipment storage and holding than fruit packed conventionally.

Decay was negligible or slight in lychees held at 45° F. for 5 days; however, in lychees held at 70°, decay was prevalent after the second or third day.

Quality of fresh lychees can be maintained if the fruit is shipped or stored at 50° F., or even as low as 35°. Good results will be obtained if the fruit is packaged and sealed in heavy-gage polyethylene bags; this is especially applicable to truck shipments. The shorter the transit and delivery period, the greater is the likelihood of the fruit maintaining its market quality until it reaches the consumer.

## INTRODUCTION

The lychee (*Litchi chinensis* Sonn.) is a subtropical fruit esteemed in China for thousands of years. The whole dried fruit, known as the "lychee nut," for many years was shipped from China to expatriated Chinese throughout the world and is more universally known than the fresh lychee. China is still the greatest producer of lychees, but the fruit is also produced in widely separated areas of the world such as Florida, Hawaii, Australia, India, and especially the Union of South Africa, where extensive plantings have recently been made (*9*).[2] Production in Florida continues to increase, especially in protected areas of southern Florida.

The United States produces only a limited quantity of lychees, most of which are consumed fresh. Unlike the flesh of the dried fruit, which resembles a prune in flavor and appearance, the fresh fruit has a white, succulent, and translucent flesh. The shell or pericarp of the dried lychee is dark brown; the fresh fruit at the time of harvest is bright red but quickly turns brown unless properly handled. Although browning of

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[1] Dr. Hatton is research horticulturist, Mr. Reeder is biological laboratory technician, and Mr. Kaufman is plant pathologist.

[2] Italic numbers in parentheses refer to Literature Cited, p. 9.

the shell does not affect the interior quality or flavor of the fruit, consumers prefer the attractive red shell color. Fresh fruit is also susceptible to decay unless promptly refrigerated.

Due to the perishable nature of fresh lychees, most Florida fruit marketed outside the State is shipped by air freight. Of 31,275 pounds of lychees shipped in 1964, 93 percent was shipped out of the State, a third of which went to New York City.[3]

Practically all of the commercial crop of Florida lychees is of the Brewster variety which matures between mid-June and early July. Several other varieties are being produced in experimental plantings. Indicative of the shortness of the lychee season is the fact that 88 percent of the Florida crop has been shipped within a period of 11 days (*5*). Descriptions of the lychee in Florida have been published (*3*, *11*).

Various reports have indicated that the storage of fresh lychees can be appreciably prolonged by refrigeration and by packaging in polyethylene to aid in maintaining fruit quality (*1*, *2*, *6*, *7*, *8*, *10*, *13*, *14*, *15*); most of the studies made use of different temperatures.

The present study, which was undertaken at the request of the Florida Lychee Growers Association, was made to determine the value of polyethylene packaging at various storage temperatures and during air and truck shipment.

## MATERIALS AND METHODS

This study was conducted during the 4-year period, 1961–64. In 1961, only holding and storage tests were made; in 1962, 1963, and 1964, shipping tests were made, followed by holding and storage tests at destination.

Test fruits were mature Brewster lychees harvested from trees at the University of Florida Sub-Tropical Experiment Station, Homestead, Fla. Stems were clipped and the fruit was weighed and separated into 10-pound lots for packing in standard ventilated corrugated cardboard cartons. Approximately 275 lychees were packed in each container.

Flavor of the lychees was rated as excellent, acceptable, and unacceptable. As inspections were conducted throughout the tests, decayed fruits were counted and discarded; such fruit was considered unacceptable, regardless of the amount of decay present per fruit.

The numerical scale for color ratings was the same as that previously used by Campbell (*2*): 1, all red; 2, browning on tips of tubercles (protuberances of the pericarp); 3, brown spots up to ¼ inch in diameter; 4, large brown spots; 5, all brown. All test fruit was rated "1" when packed. Fruits of all color ratings were acceptable, although those with ratings from 1 to 3 were the most attractive and desirable for consumer acceptance.

### Storage and Holding Tests—1961

Lychees were picked on June 19 and placed overnight in 50° F. storage. Test packages were prepared the next day and placed in chambers at temperatures of 35°, 50°, and 70° with a relative humidity of 70 to 95 percent. Storage at 50° was selected because most refrigerated trucks maintain this temperature, or slightly above, to transport mixed loads of limes and mangos. Storage at 35° was previously found satisfactory at the Miami Laboratory (*2*) and is recommended by Akamine in Hawaii (*1*).

Test packages consisted of (1) the conventional pack (lychees loosely packed in shredded paper inside the standard carton); (2) a perforated polyethylene bag, 0.0015 inch thick with eight holes ¼ inch in diameter uniformly spaced, and placed in the standard box, and (3) same as (2) above except the bag was not perforated.

Packages in the 35° and 50° F. storage chambers were replicated twice; fruit in half of the replicates was inspected for color and decay after 3 and 8 days, and fruit in the other half of the replicates was inspected only once, after 7 days. Packages in the 70° holding chamber were not replicated; fruit was inspected for color and decay after 2 and 8 days only. Color data were subjected to statistical analysis.

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[3] Florida Lychee Growers Association News Bulletin No. 25, July 1964.

### Shipping Tests—1962-64

Lychees were picked June 18, 1962, June 10, 1963, and June 15, 1964. Test packages were prepared and shipped the same day the fruit was picked. Test packages consisted of (1) conventional pack; and (2) a nonperforated polyethylene bag, 0.002 inch thick, placed in the standard box. Six containers of both types of pack were prepared. Ten pounds of fruit was weighed for each package, and recording thermometers were placed in two conventional packages and in two polyethylene packages. Three of each type of package were shipped via air freight and three via refrigerated truck.

Test packages were taken to the Market Pathology Laboratory after arrival in New York. The fruit was weighed, and atmospheres in polyethylene bags were analyzed for oxygen and carbon dioxide content. Then samples of fruit were removed from each container and inspected for general appearance, color, and the presence of decay; some were sampled for flavor. Fruit from the polyethylene bags was not returned to the bags, but remained loose in the carton. One-half of the fruit was stored at 45° F. and the other half was held at 70°, both at a relative humidity of 70 to 95 percent. Previous research at the Miami Laboratory showed that 45° was an ideal storage temperature (*2*). At various intervals from 1 to 6 days, the fruit was sampled again for flavor and reinspected for general appearance, color, and decay.

## STORAGE AND HOLDING TESTS—1961

### Color

The advantage of packing and storing fresh lychees in nonperforated polyethylene bags at 50° F. is illustrated in figure 1. Less browning of bagged lychees occurred at 50° than at 35° when the bags were not disturbed until the end of the storage period. However, in bags opened after 3 days and reopened after 8 days little difference in extent of browning was detected between fruit removed from 50° and 35°. Little or no difference in extent of browning was detected on lychees from nonperforated bags at 35° and 70°; however, at 70° browning was more rapid on fruit from the conventional packs and perforated bags than on those from the nonperforated bags.

Regardless of perforations in the bags, lychees from undisturbed bags stored at both 35° and 50° F. for 7 days developed significantly (at the 5-percent level) less browning than fruit from conventional packages at 35° and 50°.

In most tests lychees stored in nonperforated bags developed less browning than those in perforated bags, although such differences were slight. Perforated bags aided in the prevention of browning, but browning occurred on those individual fruits adjacent to the perforations. This observation is in agreement with Akamine's report (*1*) which stated that the rate of browning was related to the desiccating effect of exposure to the air.

### Decay

The amount of decayed fruit in all packages at 35° and 50° F. after 8 days was slight to negligible. For example, at 50°, 4 percent of the fruit in the perforated bags developed decay; only 0.4 percent developed decay in the conventional package at 35°. The presence of decay was most pronounced after 8 days at 70° F., at which time 19, 30, and 31 percent of the fruit had developed decay in the conventional, nonperforated, and perforated packages, respectively.

Decay organisms were not isolated in this investigation, but according to Roth in South Africa (*12*) fermentation and decay of stored lychees were caused by bacteria, yeast, and other fungi in the proportion of 3:96:1, respectively.

### Flavor

All sound lychees stored at 35° and 50° F., regardless of package, were excellent in flavor after 7 and 8 days. Most of those held at 70° were also excellent in flavor after 8 days; a few from the conventional packages were slightly less palatable, but still acceptable. Partially decayed fruit often possessed a yeasty flavor.

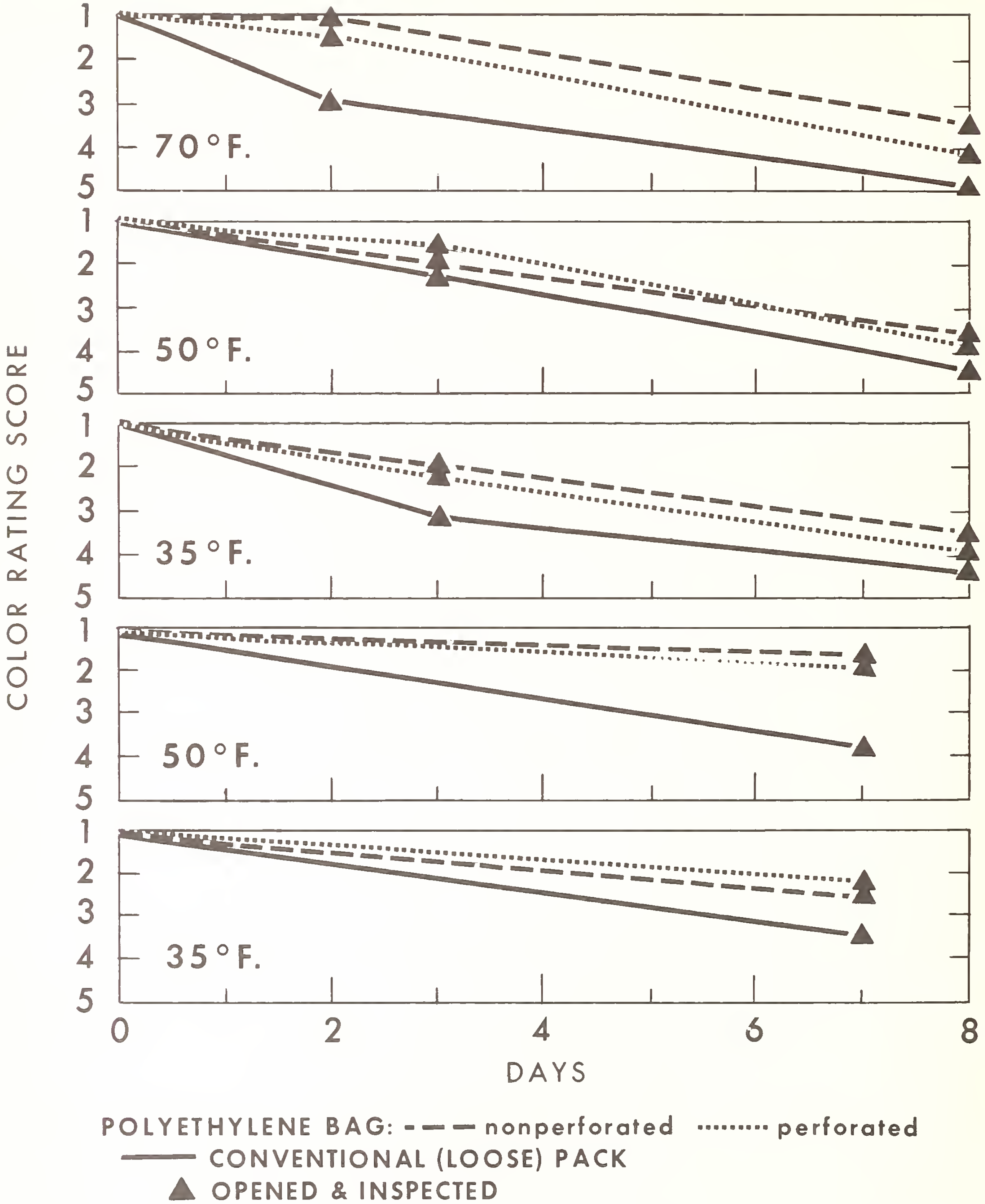

FIGURE 1.—Color ratings of fresh Florida lychees after removal from conventional loose packs and perforated and nonperforated polyethylene bags at 35°, 50°, and 70° F., 1961.

# SHIPPING TESTS—1962-64

## Temperatures and Time in Transit

At time of delivery of test packages to the carriers, outside air temperatures for 1962, 1963, and 1964 were 87°, 86°, and 88°F., respectively. These relatively high temperatures were reflected to some extent in the initially recorded transit temperatures (fig. 2).

### *Air Freight*

All planes were nonstop jets with pressurized cabins maintained at approximately 72° F. In the 1962 test, transit temperatures remained within the narrow range of 78° to 80° (average 79°) until delivery was made at the Market Pathology Laboratory in New York City. In the 1963 and 1964 tests, transit temperatures decreased gradually to about 70° at the time shipments reached the destination laboratory. In 1963, average transit temperature was 74°, and in 1964, 79°.

The flights from Miami to New York required approximately 2 hours. In all tests, the fruit arrived at the New York air terminal before 8:00 p.m. of the day it was shipped. The greatest delay was the overnight holding of the fruit at the destination terminal. The time of commercial surface delivery the next day to the laboratory was somewhat variable. In 1962, delivery was made approximately 21 hours after the test packages were given to the air carrier in Miami. The 1963 and 1964 shipments were delivered after 24 and 18 hours, respectively.

### *Refrigerated Truck*

For all 3 years, temperature in the refrigerated trucks decreased rapidly to about 60° F. soon after loading. Considerable temperature fluctuation occurred during the 1962 and 1964 shipments; this was due to the discharging and possible loading of other commodities en route to New York. During the 1962, 1963, and 1964 shipments, 61°, 54°, and 50° F., respectively, were the lowest recorded temperatures. The 50° and 54° lows were reached only upon arrival at the destination terminal. The average en route temperatures were approximately 67°, 61°, and 60°, respectively, for the 1962, 1963, and 1964 shipments.

The time en route from Miami to the Laboratory in New York varied from about 40 hours in 1963, which indicated that this particular shipment was not delayed en route for loading and unloading, to 60 hours in 1962, and 68 hours in 1964.

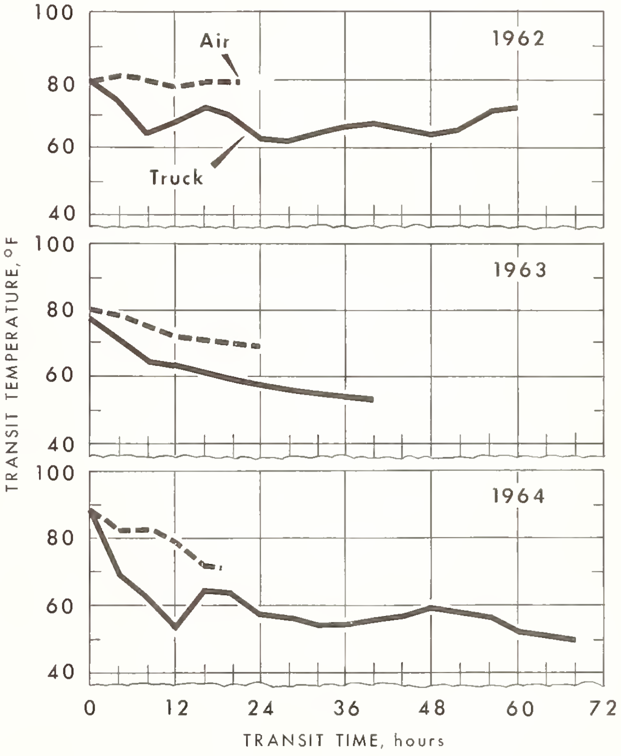

FIGURE 2.—Transit temperatures of fresh lychees shipped by air freight and refrigerated truck from Miami, Fla., to laboratory in New York City.

## Arrival Condition

### *Color*

Lychees from both air and truck shipments arrived in good conditions in all tests. Appearance was attractive, although browning on the tips of fruit tubercles was present (table 1). Generally, lychees from the air shipments during 1962 and 1964 retained a brighter red color than fruit from the truck shipments. Extent of browning was directly associated with the transit time and temperature. In the 1963 test, in which the truck transit time was shorter than usual and temperature lower, the truck shipment arrived with less browning than the air shipment. Carriers should make every effort to maintain temperatures near 50° F., or as low as 35°, if possible, and to shorten transit and subsequent delivery time.

The use of polyethylene bags for packing lychees is desirable for retention of color (table 1); this is especially true in shipments via refrigerated truck because of the relatively long time involved. Lychees packed in polyethylene bags, regardless of carrier, usually retained a brighter red color than those packed loosely in the conventional manner. Bagged fruits also retained a fresher appearance and were more turgid than those packed conventionally. Moisture condensation developed inside the bags in most air and truck shipments, and according to Akamine (*1*), such condensation was beneficial in preventing desiccation and browning of the fruits.

### *Decay*

In all tests, lychees from both air and truck shipments arrived with less than 2 percent decayed fruit (table 1). More decay was present in fruit from the air shipments than from the truck shipments, due to the relatively high temperatures in the planes and to the lack of adequate refrigeration at New York prior to delivery of the lychees to the laboratory. Type of package had no consistent effect on number of decayed fruit.

### *Flavor*

Sound lychees from all packages and shipments were excellent in flavor upon arrival.

TABLE 1.—*Arrival condition of fresh Florida lychees shipped to New York via air freight and refrigerated truck, 1962–64*

[Each value based on a total of 450 fruits, 150 from each of 3 containers]

| Year and type of pack | Color [1] | | Decay | |
|---|---|---|---|---|
| | Air | Truck | Air | Truck |
| 1962 | *Rating* | *Rating* | *Percent* | *Percent* |
| Conventional ----- | 2.3 | 2.8 | 0.7 | 0 |
| Polyethylene ----- | 2.3 | 2.6 | 0 | .2 |
| 1963 | | | | |
| Conventional ----- | 2.3 | 2.2 | .7 | .4 |
| Polyethylene ----- | 2.2 | 2.0 | 1.3 | .2 |
| 1964 | | | | |
| Conventional ----- | 2.2 | 2.9 | 1.8 | 0 |
| Polyethylene ----- | 2.0 | 2.4 | .7 | .2 |

[1] Rating scale: 1, all red; 2, browning on tips of tubercles; 3, brown spots up to ¼ inch diameter; 4, large brown spots; 5, all brown.

### *Weight Loss*

Regardless of method of shipment, weight loss during shipment was negligible for lychees in polyethylene bags (table 2). Weight loss of fruit in the conventional packages ranged from 3.3 to 5.7 percent in the air shipments and from 1.7 to 7.0 percent in the truck shipments. These results are similar to those reported by Dennison and Hall (*4*).

### *Atmospheres*

Except in the 1962 shipments and in the 1964 air shipment, atmospheres were not greatly modified in the polyethylene bags (table 2). Most likely the tubercles of the fruit punctured the bags and caused loss of carbon dioxide and entry of some oxygen.

## Condition After Storage (45° F.)

### *Color*

In all tests lychees from both air and truck shipments were still commercially acceptable after 5 days at 45° F., but brown spots up to ¼ inch in diameter were prevalent (table 3). Although lychees shipped in polyethylene bags

TABLE 2.—*Average arrival weight loss by type of pack and average bag atmosphere of fresh Florida lychees shipped to New York via air freight and refrigerated truck, 1962-64*

[Averages are based on 3 containers for each percentage value]

| Year and type of pack [1] | Weight loss | | Atmosphere | | | |
|---|---|---|---|---|---|---|
| | | | Air | | Truck | |
| | Air | Truck | Carbon dioxide | Oxygen | Carbon dioxide | Oxygen |
| | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| 1962 | | | | | | |
| Conventional | 3.3 | 1.7 | ---------- | ---------- | ---------- | ---------- |
| Polyethylene | 0 | 0 | 18.1 | 10.0 | 10.2 | 12.8 |
| 1963 | | | | | | |
| Conventional | 5.7 | 3.3 | ---------- | ---------- | ---------- | ---------- |
| Polyethylene | 0 | 0 | 2.3 | 19.0 | 4.1 | 15.7 |
| 1964 | | | | | | |
| Conventional | 4.3 | 7.0 | ---------- | ---------- | ---------- | ---------- |
| Polyethylene | 0 | 0.3 | 7.9 | 14.3 | 2.1 | 18.8 |

[1] Conventional pack: Corrugated cardboard box, 10 pound capacity, with fruit loosely packed in shredded paper. Polyethylene pack: Corrugated cardboard box, 10 pound capacity, with fruit packed in polyethylene bag.

TABLE 3.—*Condition of fresh Florida lychees shipped to New York via air freight and refrigerated truck, after storage for several days at 45° F., 1962-64* [1]

[Each value based on a total of 300 fruits, 100 from each of 3 containers]

| Year and type of pack | Color [2] | | | | Decay | | | |
|---|---|---|---|---|---|---|---|---|
| | Air | | Truck | | Air | | Truck | |
| | 2 days | 5 days | 3 days | 5 days | 2 days | 5 days | 3 days | 5 days |
| | *Rating* | *Rating* | *Rating* | *Rating* | *Pct.* | *Pct.* | *Pct.* | *Pct.* |
| 1962 | | | | | | | | |
| Conventional | 3.0 | 3.4 | 3.2 | 3.5 | 0.7 | 2.0 | 1.3 | 2.0 |
| Polyethylene | 3.3 | 3.3 | 3.1 | 3.4 | .3 | .7 | 1.7 | 2.0 |
| 1963 | | | | | | | | |
| Conventional | 2.5 | 3.1 | -------- | 3.2 | 3.3 | 5.0 | --------- | 1.0 |
| Polyethylene | 2.5 | 2.8 | -------- | 3.0 | 3.7 | 2.0 | --------- | 1.3 |
| 1964 [3] | | | | | | | | |
| Conventional | 3.1 | 3.1 | -------- | 3.2 | 0 | 1.7 | --------- | .7 |
| Polyethylene | 3.2 | 3.1 | -------- | 2.7 | 0 | 1.7 | --------- | 2.0 |

[1] In 1962, storage temperatures were maintained at 47° F.; in 1964, they ranged from 43° to 49°. All fruit was loose in boxes during storage period.

[2] Rating scale: 1, all red; 2, browning on tips of tubercles; 3, brown spots up to ¼ inch diameter; 4, large brown spots; 5, all brown.

[3] Air shipment was inspected after 3 and 6 days' storage; truck shipment was inspected after 4 days in storage.

were removed from the bags for storage, in a few cases the sustaining effect of bagging on color retention of the fruit was apparent during storage, especially in fruit from the 1964 truck shipment.

### *Decay*

Regardless of shipment or type of transit package, decay during storage was not excessive after 5 days (table 3).

### *Flavor*

Sound lychees from all packages and shipments were excellent in flavor after storage for 5 days at 45° F.

## Condition After Holding (70° F.)

### *Color*

In all tests lychees from both air and truck shipments were still commercially acceptable after 5 days at 70° F. although brown spots up to ¼ inch or larger in diameter were common (table 4). After 6 days, lychees from the air shipment of 1964 had acceptable internal quality although the fruits were almost totally brown. In most cases, lychees shipped in polyethylene bags continued to have less browning than those shipped loose in conventional packages. Regardless of shipping method or type of package, browning was more rapid at 70° than at 45°.

TABLE 4.—*Condition of fresh Florida lychees shipped to New York via air freight and refrigerated truck, and held several days at 70° F., 1962-64* [1]

[Each value based on a total of 300 fruits, 100 from each of 3 containers]

| Condition, year, and type of pack | Air | | | | | Truck | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 day | 2 days | 4 days | 5 days | 6 days | 1 day | 3 days [2] | 4 days | 5 days |
| COLOR [3] | *Rating* | *Rating* | *Rating* | *Rating* | *Rating* | *Rating* | *Rating* | *Rating* | *Rating* |
| 1962: | | | | | | | | | |
| Conventional | -------- | 3.3 | -------- | 3.8 | -------- | -------- | 3.6 | -------- | -------- |
| Polyethylene | -------- | 3.3 | -------- | 3.8 | -------- | -------- | 3.5 | -------- | -------- |
| 1963: | | | | | | | | | |
| Conventional | 2.9 | -------- | -------- | 3.5 | -------- | -------- | -------- | 3.3 | 3.4 |
| Polyethylene | 2.6 | -------- | -------- | 3.3 | -------- | -------- | -------- | 3.2 | 3.3 |
| 1964: | | | | | | | | | |
| Conventional | 2.8 | -------- | 4.2 | -------- | 4.8 | 3.6 | -------- | 4.1 | -------- |
| Polyethylene | 2.6 | -------- | 3.9 | -------- | 4.8 | 2.9 | -------- | 4.4 | -------- |
| DECAY | *Pct.* | *Pct.* | *Pct.* | *Pct.* | *Pct.* | *Pct.* | *Pct.* | *Pct.* | *Pct.* |
| 1962: | | | | | | | | | |
| Conventional | -------- | 0.3 | -------- | 0.7 | -------- | -------- | 1.3 | -------- | -------- |
| Polyethylene | -------- | 0 | -------- | .7 | -------- | -------- | .7 | -------- | -------- |
| 1963: | | | | | | | | | |
| Conventional | 1.0 | 1.0 | -------- | 9.7 | -------- | 0.7 | -------- | -------- | 5.0 |
| Polyethylene | .3 | 3.3 | -------- | 12.3 | -------- | .7 | -------- | -------- | 2.3 |
| 1964: | | | | | | | | | |
| Conventional | .7 | -------- | 1.3 | -------- | 7.0 | .7 | -------- | 5.3 | -------- |
| Polyethylene | 1.0 | -------- | 4.0 | -------- | [4] 15.3 | 2.0 | -------- | 3.7 | -------- |

[1] All fruit was loose in boxes during holding periods.

[2] Three days at 47° F. (1962) followed by 3 days at 70°.

[3] Rating scale: 1, all red; 2, browning on tips of tubercles; 3, brown spots up to ¼ inch diameter; 4, large brown spots; 5, all brown.

[4] Excessive decay was partially due to cuts and bruises caused by recording thermometer during transit.

### *Decay*

Regardless of shipment or type of transit package, decay at 70° F. was negligible for the first 2 or 3 days, thereafter it became more prevalent (table 4). Accordingly, exposure of bagged lychees to high temperatures (70° F.) should be avoided due to the rapid development of decay.

### *Flavor*

Sound lychees from all packages and shipments were excellent in flavor after holding for 2 days at 70° F.; thereafter, the flavor gradually diminished. However, no fruits were unacceptable in flavor except those with decay; these possessed a yeasty flavor.

## LITERATURE CITED

(1) AKAMINE, E. K.
1960. PREVENTING THE DARKENING OF FRESH LYCHEES PREPARED FOR EXPORT. Hawaii Agr. Expt. Sta. Tech. Prog. Rpt. 127, 18 pp.

(2) CAMPBELL, C. W.
1959. STORAGE BEHAVIOR OF FRESH BREWSTER AND BENGAL LYCHEES. Fla. State Hort. Soc. Proc. (1958) 72: 356–360.

(3) COBIN, MILTON
1954. THE LYCHEE IN FLORIDA. Fla. Agr. Expt. Sta. Bul. 546, (Rev.), 35 pp., illus.

(4) DENNISON, R. A., and HALL, C. B.
1957. STUDIES ON THE HANDLING OF FRESH LYCHEES. Fla. Lychee Growers Assoc. Yearbook (1956) 3: 31–33.

(5) GROVE, W. R., JR.
1958. LYCHEE MARKETING HIGHLIGHTS—1957. Fla. Lychee Growers Assoc. Yearbook (1957) 4: 31–33.

(6) MACFIE, G. B., JR.
1955. PACKAGING AND STORAGE OF LYCHEE FRUITS, PRELIMINARY EXPERIMENTS. Fla. Lychee Growers Assoc. Yearbook (1954) 1: 44–48.

(7) ———
1955. WRAPPING AND PACKAGING OF FRESH LYCHEES. Fla. Lychee Growers Assoc. Yearbook (1954) 1: 25–28.

(8) ———
1956. PACKAGING AND HANDLING OF FRESH LYCHEE FRUIT. Fla. Lychee Growers Assoc. Yearbook (1955) 2: 15–16.

(9) MARLOTH, R. H.
1949. THE LITCHI IN SOUTH AFRICA. S. Africa Citrus and Sub-Trop. Hort. Res. Sta. Bul. 286 (Rev.), 16 pp.

(10) MUKERJEE, P. K.
1957. PRESERVATION OF NATURAL COLOUR IN LITCHIES UNDER COLD STORAGE. Sci. and Cult. 23 (2): 101.

(11) MUSTARD, M. J.
1964. LYCHEES. Fruit and Vegetable Facts and Pointers, United Fresh Fruit and Vegetable Assoc., Aug. 1964. 4 pp.

(12) ROTH, G.
1963. POST HARVEST DECAY OF LITCHI FRUIT. S. Africa Dept. Agr. Tech. Serv., Tech. Commun. 11, 16 pp., illus.

(13) SINGH, R.
1957. IMPROVEMENT OF PACKING AND STORAGE OF LITCHI AT ROOM TEMPERATURE. Indian Jour. Hort. 14: 205–212.

(14) THOMPSON, B. D.
1955. THE EFFECT OF PREPACKAGING AND COLD STORAGE ON THE QUALITY OF FRESH LYCHEES. Fla. Lychee Growers Assoc. Yearbook (1954) 1: 22–25.

(15) ———
1956. A PROGRESS REPORT ON HANDLING AND STORAGE OF FRESH LYCHEES. Fla. Lychee Growers Assoc. Yearbook (1955) 2: 27–28.

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